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(54) **UNDERWATER LIGHTING SYSTEM WITH BATHER DETECTION CIRCUITRY**

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G08B 5/36 (2006.01)

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CPC ***G08B 21/08*** (2013.01); ***G08B 5/36*** (2013.01)

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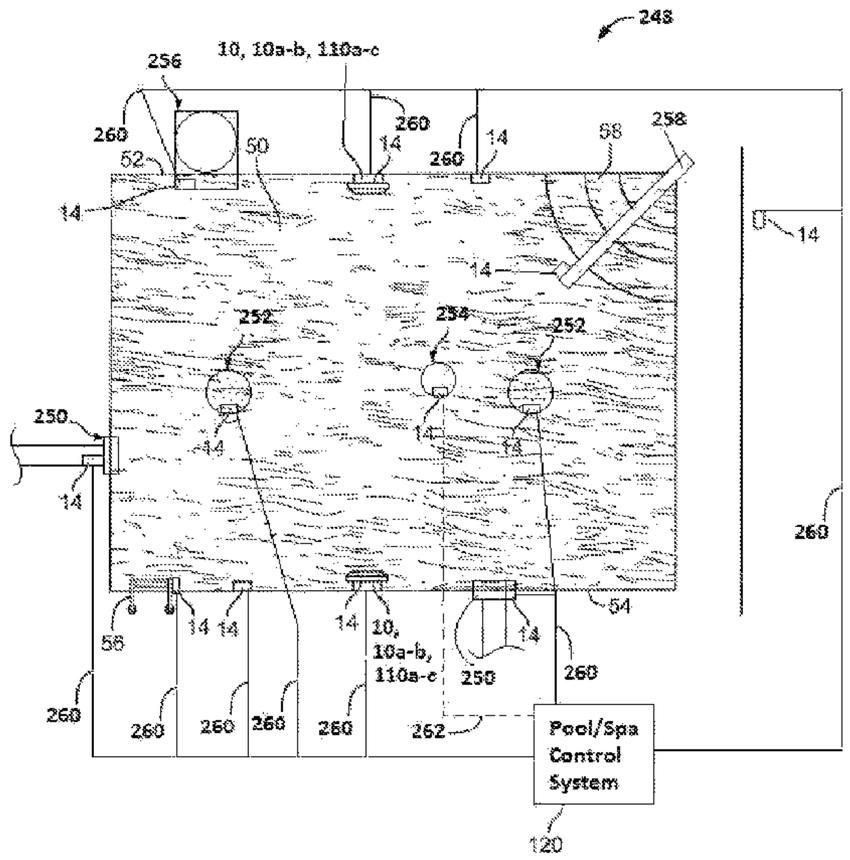
(57) **ABSTRACT**

The present disclosure relates to a lighting fixture for use in connection with a swimming pool or spa. The lighting fixture includes a light source, and a detection device for detecting the presence of a bather in a pool or a spa. A microprocessor is in electrical communication with the detection device and the light source. The microprocessor adjusts an output of the light source when a bather is detected in the pool or the spa. The microprocessor could adjust the color of the light emitted by the light source when a bather is detected. Also provided is a bather condition/activity detection system which utilizes pool or spa devices to detect various bather conditions/activities such as bather ingress, egress, drowning, distress, etc.

6 Claims, 6 Drawing Sheets



(58) **Field of Classification Search**
CPC G02B 6/0031; G08B 5/36; G10L 15/30; G10L 15/22; G10L 2015/223; F21Y 2115/10
See application file for complete search history.

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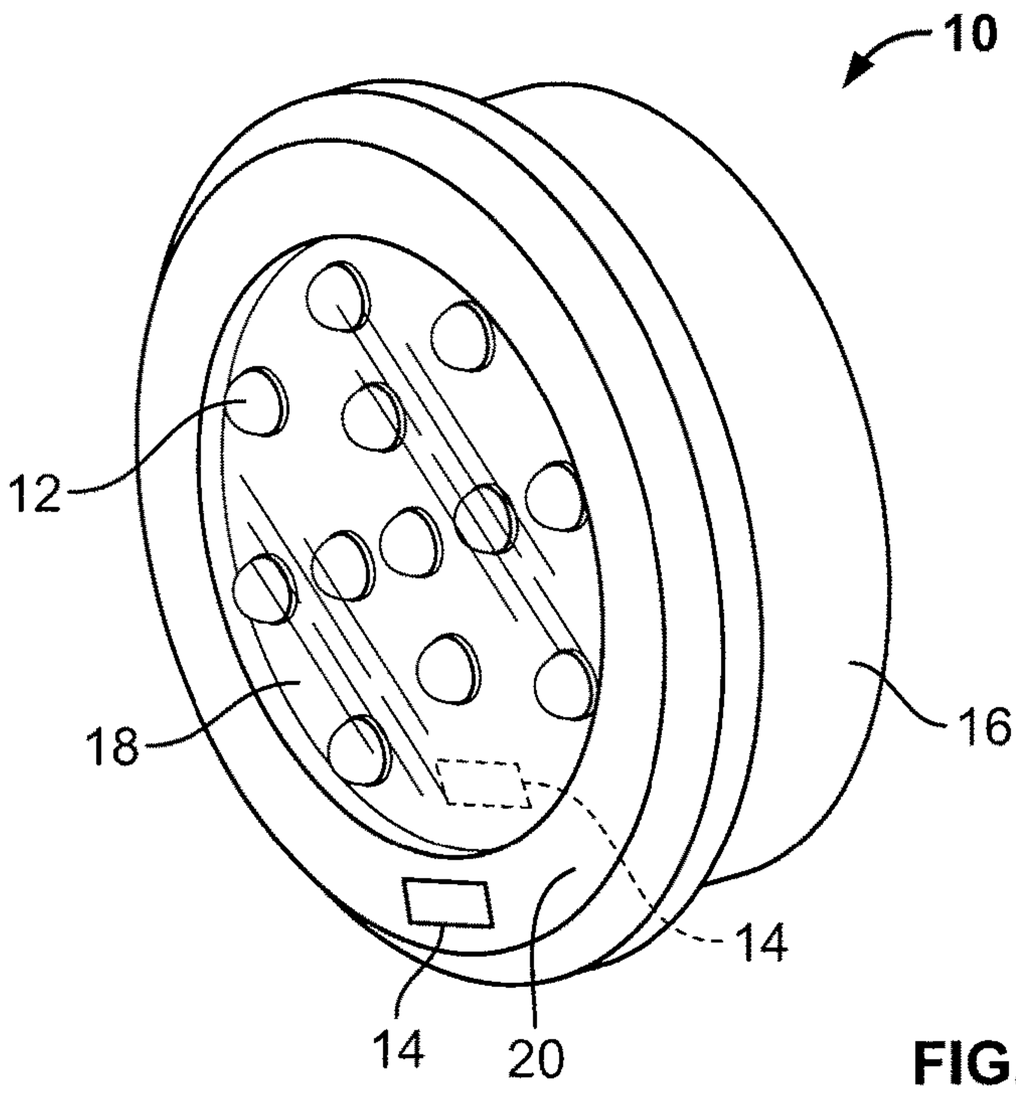
10
12
18
16
14
14
20

FIG. 1

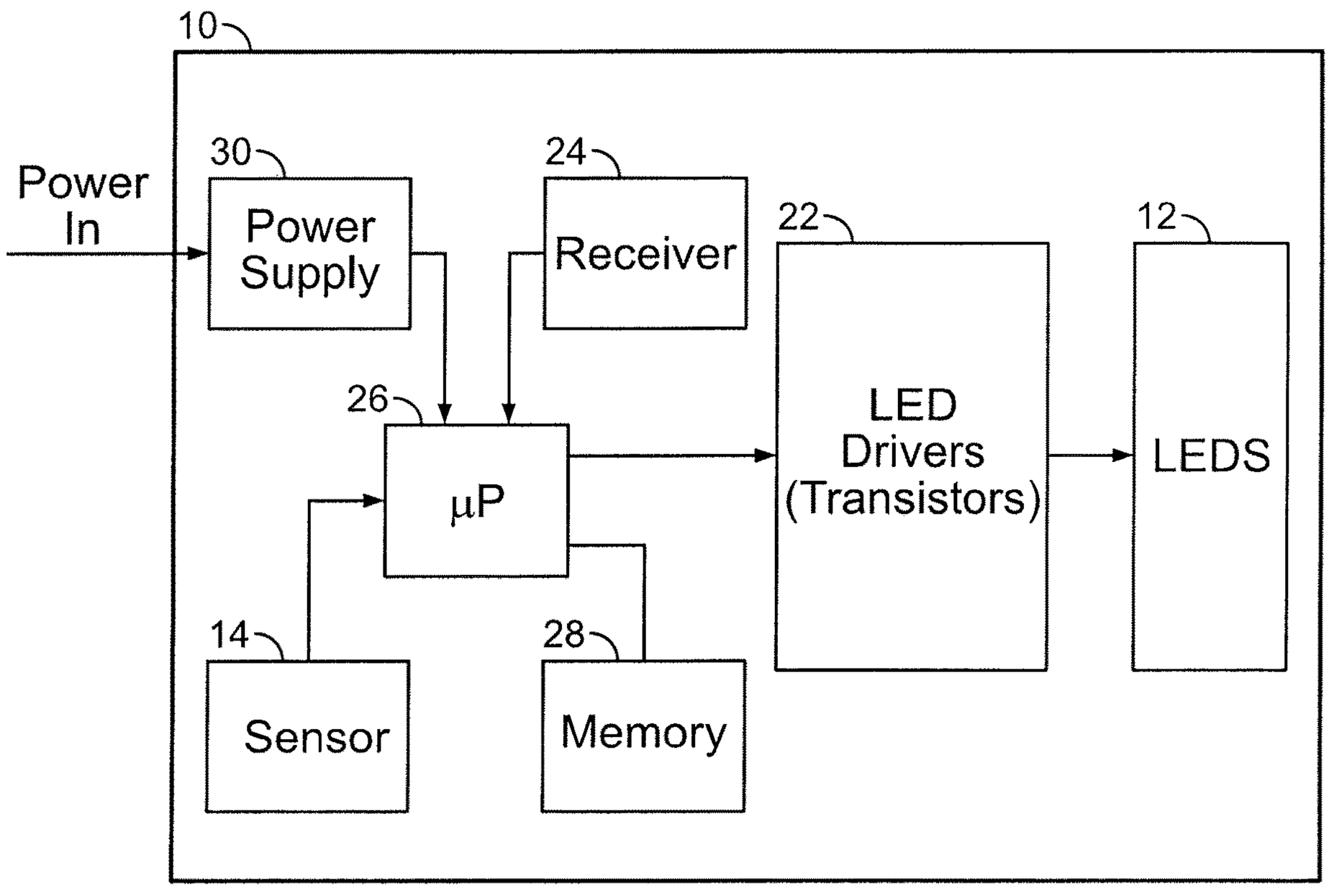
10
30
Power In
Power Supply
24
Receiver
22
LED Drivers (Transistors)
12
LEDS
26
μP
14
Sensor
28
Memory

FIG. 2

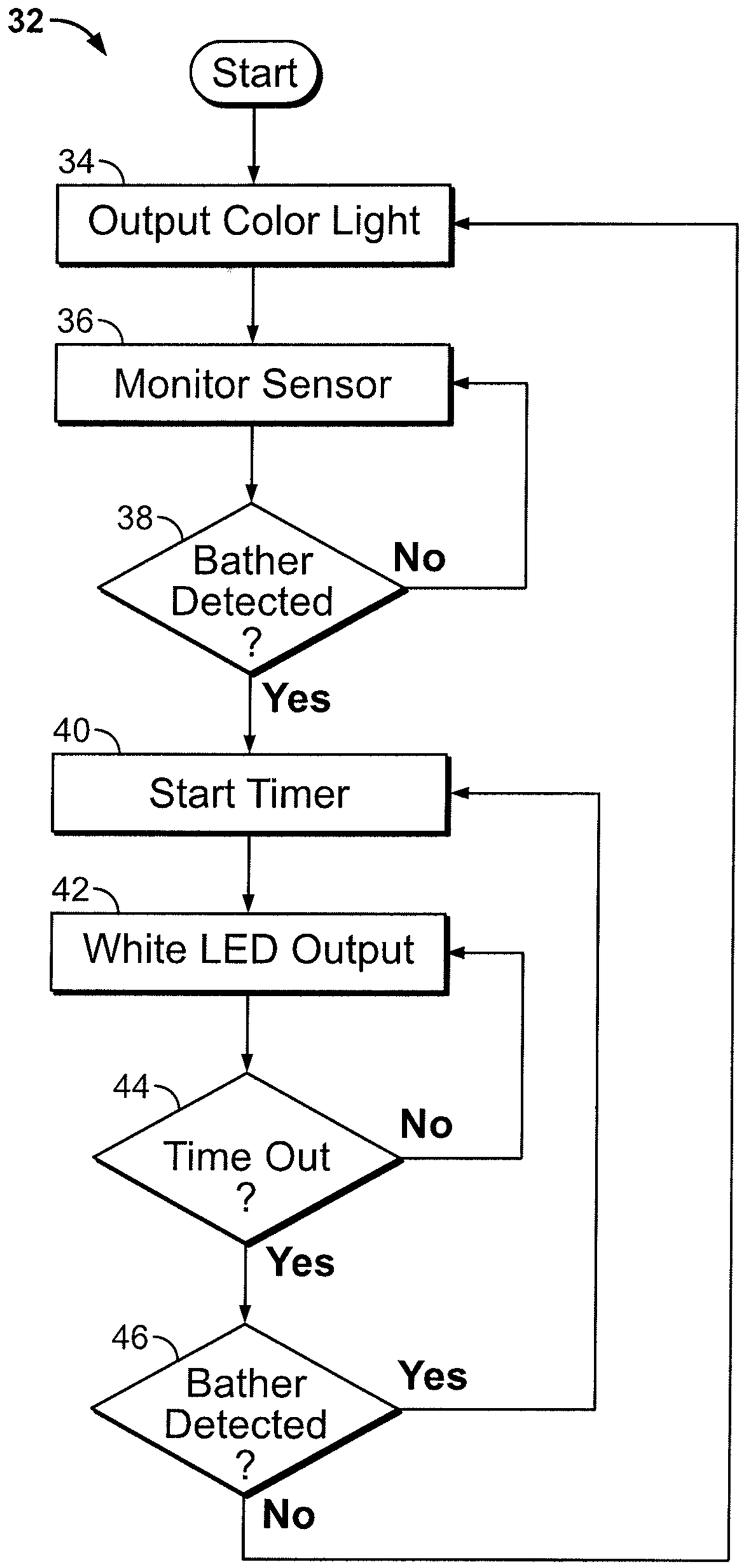
32
Start
34
Output Color Light
36
Monitor Sensor
38
Bather Detected ?
No
Yes
40
Start Timer
42
White LED Output
44
Time Out ?
No
Yes
46
Bather Detected ?
Yes
No

FIG. 3

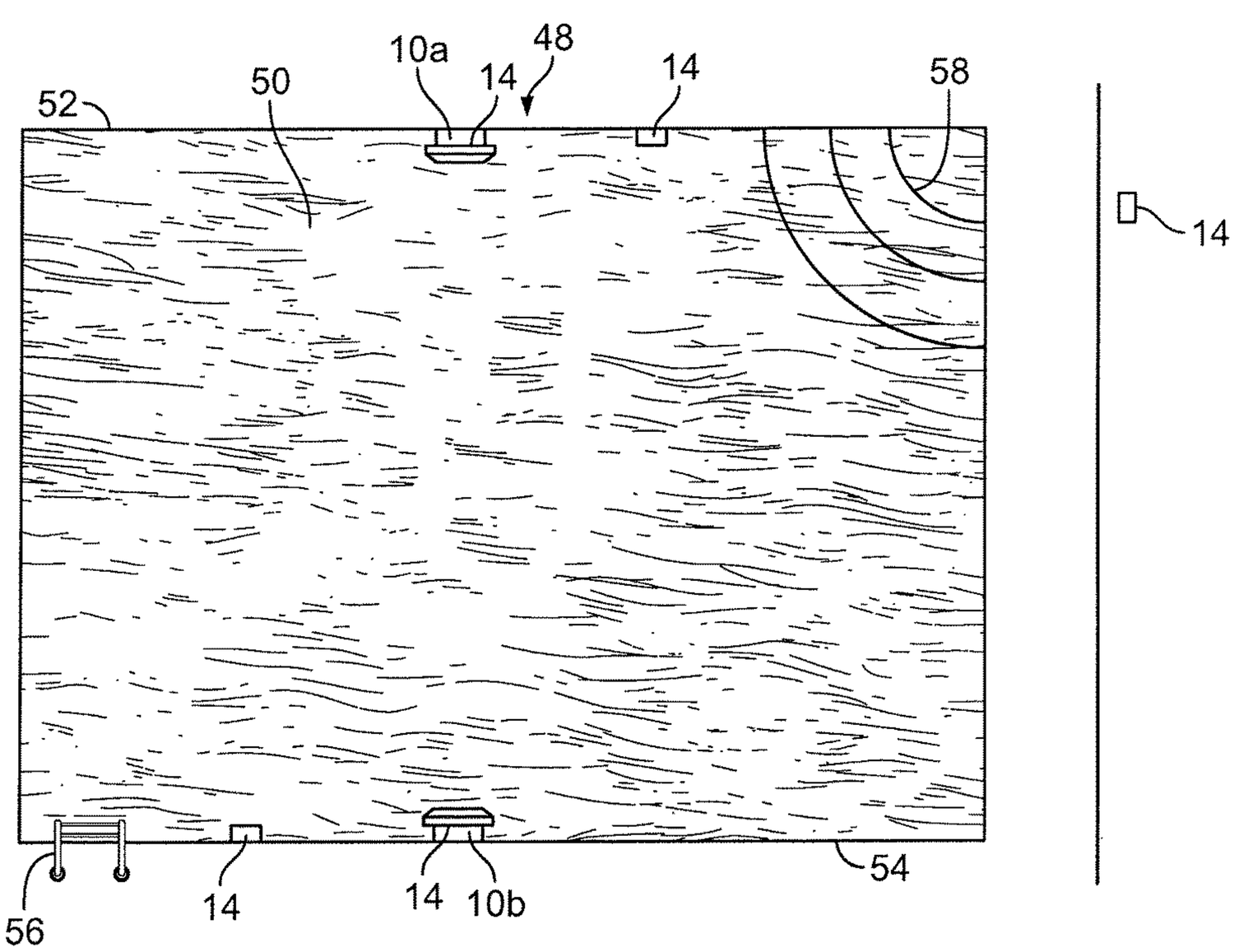

FIG. 4

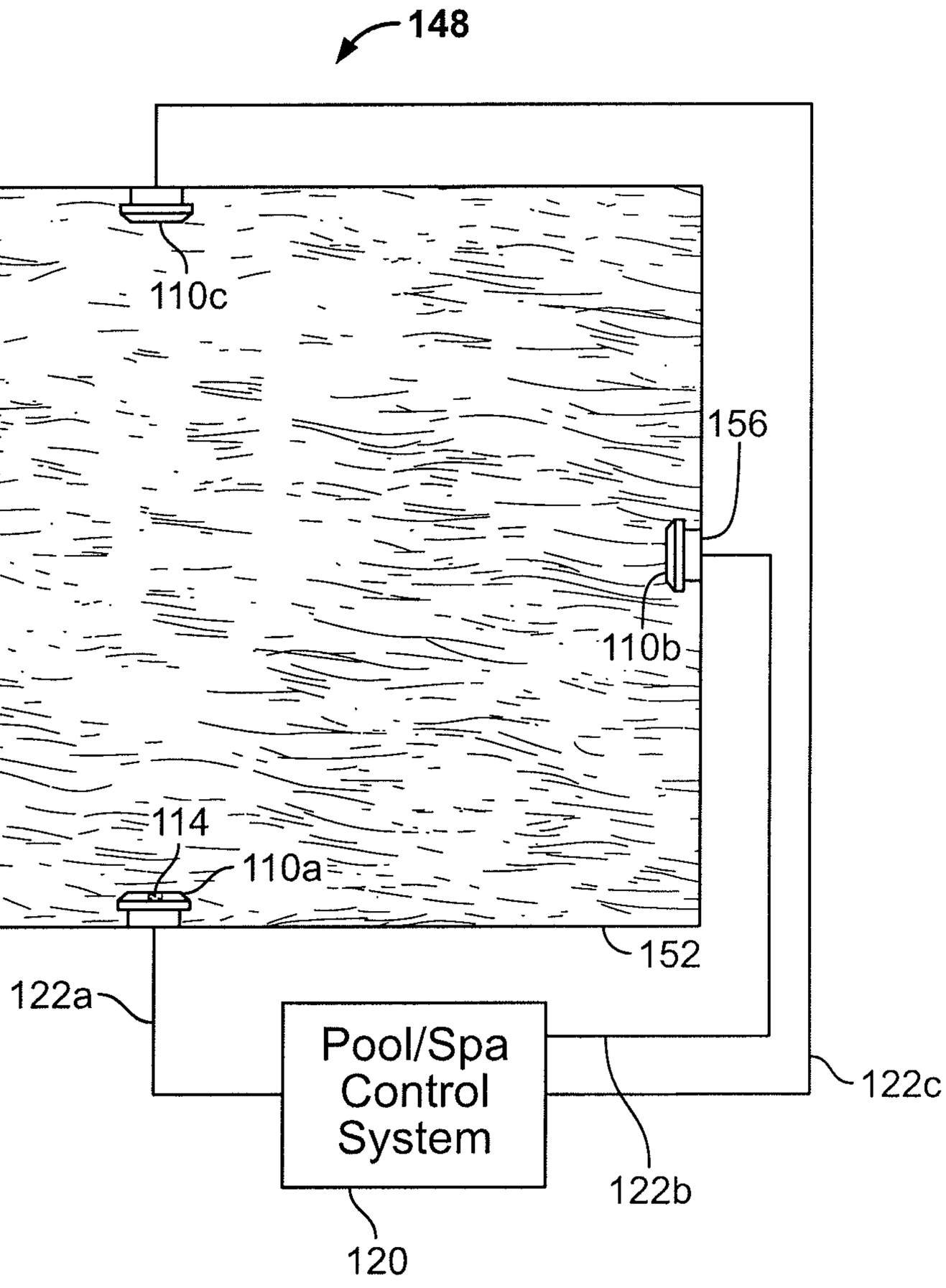
148
154
150
110c
156
110b
114
110a
152
122a
Pool/Spa
Control
System
122c
122b
120

FIG. 5

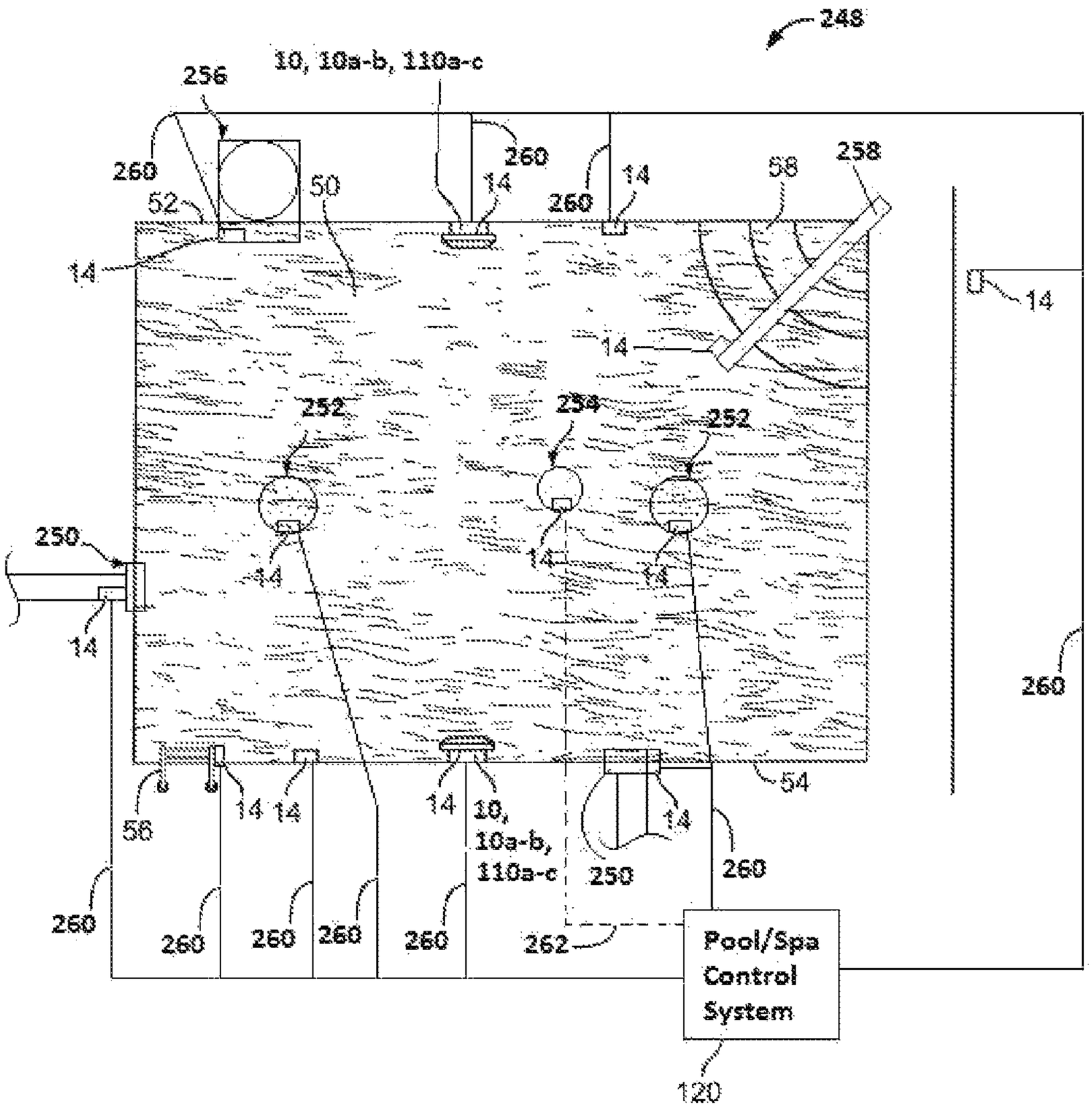
248
256
10, 10a-b, 110a-c
260
260
14
260
14
58
258
52
50
14
14
14
252
254
252
250
14
14
14
14
56
14 14
14
10, 10a-b, 110a-c
14
54
260
250
260
260
260
260
260
260
260
262
Pool/Spa Control System
120

FIG. 6

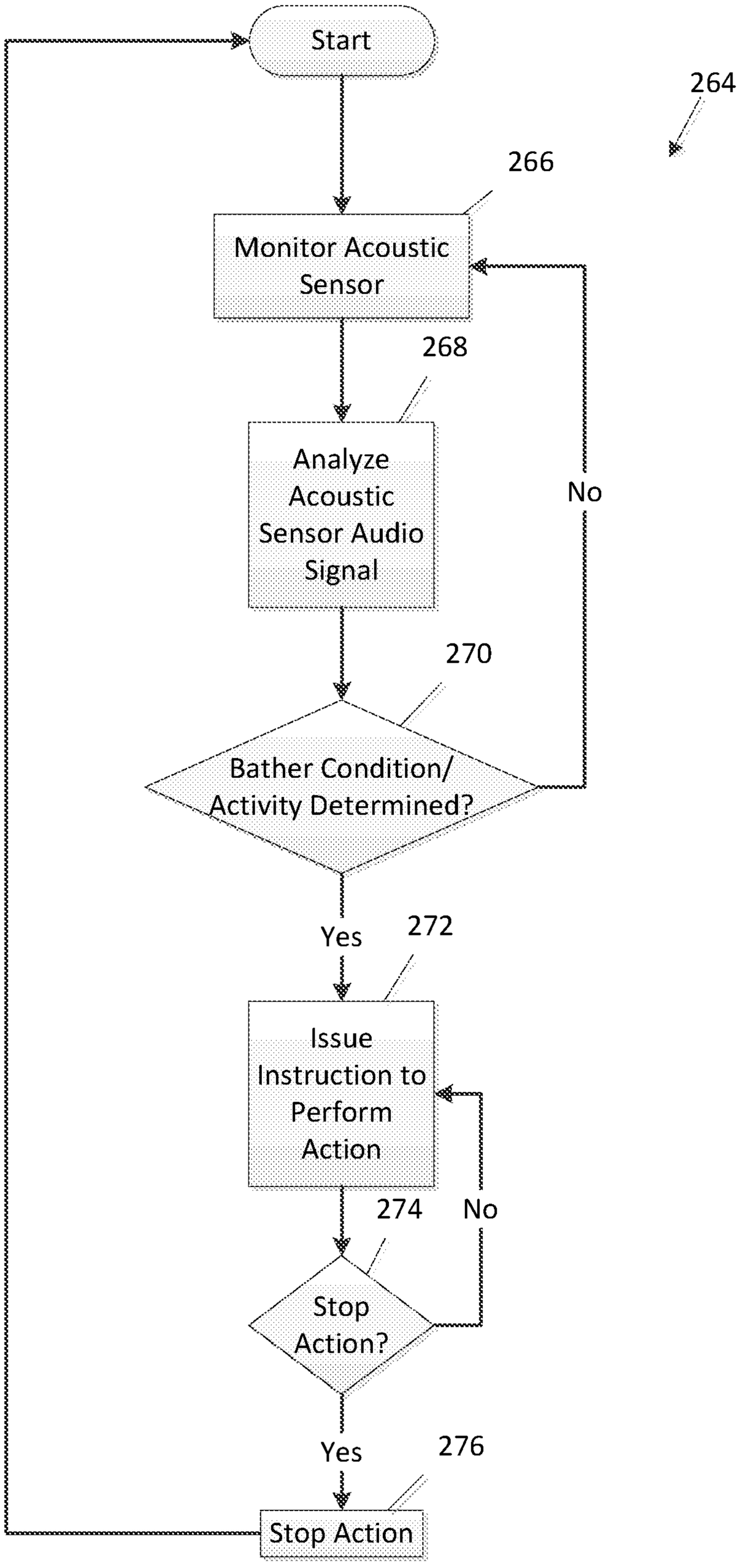
Start
264
266
Monitor Acoustic Sensor
268
Analyze Acoustic Sensor Audio Signal
270
Bather Condition/ Activity Determined?
No
Yes
272
Issue Instruction to Perform Action
274
No
Stop Action?
Yes
276
Stop Action

FIG. 7

UNDERWATER LIGHTING SYSTEM WITH BATHER DETECTION CIRCUITRY

RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Non-Provisional application Ser. No. 14/205,936 filed on Mar. 12, 2014, which is a continuation-in-part of U.S. Non-Provisional application Ser. No. 13/840,751 filed on Mar. 15, 2013, the entire disclosures of which are expressly incorporated herein by reference.

FIELD OF THE DISCLOSURE

The present disclosure relates to underwater lighting systems, and more particularly to lighting systems with bather detection circuitry for use in swimming pools, spas and the like.

RELATED ART

In-ground commercial and residential swimming pools and spas are often installed with lights, typically in a horizontal row a short distance below the waterline. These lights conventionally were standard white lights. More recently, color-changing lights have been used, with programmable controllers for turning selected lights on and off, effectively producing an underwater light show for the pool's bathers and bystanders/spectators. Adequate lighting in pools and spas is important for safety reasons for bathers. There is a generally a higher standard of pool/spa illumination for safe active bather use and a lesser standard for safe pool/spa illumination for bystanders/spectators.

In a typical application, an underwater light fixture (also called a luminaire) includes an array of light-emitting diodes (LEDs) coupled to a microprocessor. LEDs are available in various colors (e.g., red, green, blue, white, etc.). A specific color in a light fixture may be obtained by powering different LEDs in combinations of primary colors (e.g., LEDs in red, green and blue). The light fixture could be programmed to change colors at certain time intervals.

In certain jurisdictions, commercial and residential swimming pools and spas may have minimum illumination requirements for safe use. While color-changing LED lights have a pleasing visual effect, they may emit lumens in certain color modes that are below the minimum illumination requirements. As such, existing color LED pool and spa lights may not be suitable for use in certain applications because they do not meet applicable lighting codes. It is therefore desirable to provide a lighting system where the color-changing LED light may automatically change its output so that the light emits a sufficient amount of lumens when bathers are in a pool or spa.

SUMMARY

In accordance with the present disclosure, a lighting fixture is provided for use in connection with a swimming pool or spa. In particular, the lighting fixture includes a light source, and a detection device for detecting the presence of a person within a pool or spa. The detection device transmits a signal into the pool/spa water, and receives a reflected signal from a bather in the pool or spa to detect the presence of the bather. A microprocessor is in electrical communication with the detection device and the light source. The microprocessor adjusts an output of the light source when the bather is detected, so that sufficient light output is generated by the underwater lighting fixture.

In accordance with another embodiment, a lighting system for use in connection with a swimming pool or spa is provided. The lighting system includes a lighting fixture with a light source, a microprocessor for controlling the light source, and a mechanism for detecting the presence of a person within a pool or a spa. The microprocessor changes the color of light emitted from the light source such that the light source emits white color when the bather is detected within the pool or spa.

In another embodiment, a method for controlling a lighting fixture in a swimming pool or spa is provided. The method includes the steps of illuminating a pool or spa with a lighting fixture, detecting the presence of a person in the pool or spa, and changing the color output of the lighting fixture to an acceptable lighting condition (e.g., white light output, white and/or color output at acceptable lumen level, etc.) when a person is detected in the pool or spa.

The present invention further relates to a bather condition/activity detection system for a pool or spa, comprising: a pool or spa device positionable at least partially within water of a pool or spa; an acoustic sensor associated with the pool or spa device and configured to sense underwater sound and produce a signal indicative of the underwater sound; and a processor in communication with the acoustic sensor and configured to analyze the signal to determine if a bather condition/activity is present in the pool or spa, wherein the processor issues an instruction to perform an action upon a determination that a bather condition/activity is present in the pool or spa.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing features of the present disclosure will be apparent from the following Detailed Description, taken in connection with the accompanying drawings, in which:

FIG. **1** is a perspective view showing an underwater color-changing light fixture with bather detection circuitry in accordance with the present disclosure;

FIG. **2** is a block diagram of the light fixture of light fixture of FIG. **1**;

FIG. **3** is a flowchart showing processing steps according to an embodiment of the present disclosure for detecting a bather in a pool or spa and controlling output of an underwater pool/spa light based on detection of a bather;

FIG. **4** schematically illustrates a lighting system constructed in accordance with the present disclosure for use in connection with a swimming pool;

FIG. **5** schematically illustrates a lighting system constructed in accordance with an embodiment of the present disclosure for use in connection with a swimming pool;

FIG. **6** schematically illustrates a bather condition detection system constructed in accordance with an embodiment of the present disclosure for use in connection with a swimming pool; and

FIG. **7** is a flowchart showing processing steps according to an embodiment of the present disclosure for detecting a bather condition or activity and indicating an alarm based on a detected bather condition.

DETAILED DESCRIPTION

The present disclosure relates to an underwater color-changing light fixture having detection circuitry for detecting bathers in a swimming pool, spa, or the like. When the detection circuitry detects a bather, the light fixture auto-

matically changes the color of the emitted light such that the light fixture emits a constant light having a fixed color, such as white light.

FIG. **1** is a perspective view showing an underwater color-changing light fixture **10** of the present disclosure. The light fixture **10** includes one or more light emitting diodes (LEDs) **12** as a light generator and is adapted to be submersed underwater for providing underwater illumination. The light fixture **10** could employ differently colored LEDs **12** (e.g., red LEDs, green LEDs, blue LEDs, and white LEDs) and could be adapted to generate a variety of different colors, including white. A specific color could be obtained by powering different LEDs in combinations of primary colors (e.g., LEDs in red, green, and blue). The use of LEDs is only exemplary. It will be understood that the light fixture **10** could include a light source that is not LED-based, and/or a light source that is a combination of LED-based and non LED-based.

The light fixture **10** could include a detection device **14** located in the body **16** of the light fixture **10**, behind a central lens portion **18**, or in a bezel **20** positioned about the central lens portion **18**. Alternatively, the detection device **14** could be located remotely from the light fixture **10**, such as in any location within the vicinity of a pool or spa, or in a niche or a recess in the pool or spa that contains the light fixture **10**. The detection device **14** senses the presence of a person in a swimming pool or spa by conventional methods, such as by detecting the movement of water in the pool or spa, or by detecting infrared energy, ultrasonically, etc. The detection device **14** could be any type of sensor or detector, such as a passive and/or active sonar detector, an infrared sensor, a thermal sensor, a wave sensor, an acoustic sensor, a temperature sensor, a vibration sensor, a photosensor, a light sensor, a piezoelectric device, a transducer, or a motion detector. When the detection device **14** detects the presence of a person in a swimming pool, the light fixture **10** automatically changes or calibrates the color and/or intensity of the light such that the light fixture **10** emits a constant light having a fixed color, such as white light.

FIG. **2** is a block diagram of a light fixture **10** according to an embodiment of the present disclosure. The light fixture **10** includes several types of electrical components, such as the LEDs **12**, transistors **22** for driving the LEDs **12**, the detection device (sensor) **14**, a receiver **24**, a microprocessor **26**, one or more memories **28**, and a power supply **30**. The memory **28** stores preset light programs and/or algorithms for controlling output of the fixture **10**. The power supply **30** provides power to the microprocessor **26** and to the light fixture **10**.

The microprocessor **26** controls the color of the light emitted from the LEDs **12**, as disclosed in co-pending U.S. patent application Ser. No. 11/946,685, the entire disclosure of which is expressly incorporated herein by reference. In particular, the microprocessor **26** executes programs that could be a list of colors (i.e., a set of steps) to be played back in order and a time between the steps. The programs could include one or more color-changing light programs. When one of the color-changing light programs is executed, the light fixture **10** generates a lightshow by sequentially producing lights having predetermined colors, each color displayed for a certain period of time. For example, the light fixture **10** could sequentially generate a light having a red color, a light having a blue color, and a light having a white color, each color displayed for two seconds. Additionally, the programs could include one or more fixed light programs. When one of the fixed light programs is selected, the light fixture **10** generates a constant light having a fixed color. For example, the light fixture **10** could transmit a constant light having a blue color.

The microprocessor **26** is in communication with the detection device **14**. In particular, the microprocessor **26** receives reflected signals that have been emitted from the detection device **14**, processes the signal, and adjusts the color of the light emitted from the LEDs **12** when a bather has been detected. In one embodiment, the microprocessor **26** adjusts the color of light emitted from the LEDs **12** based on the signal received from the detection device **14** such that the light fixture **10** transmits a constant light having an acceptable lumen output (e.g., white light or color light). Optionally, a separate receiver **24** could be provided for receiving/detecting reflected signals from a bather.

The microprocessor **26** could adjust or calibrate parameters of the LEDs **12**, other than color. For example, the microprocessor **26** could adjust the brightness of the light emitted from the LEDs **12** and/or other parameters of the LEDs **12** such that the light fixture **10** transmits a light having a brightness, intensity, and/or color sufficient to satisfy the minimum illumination requirements of applicable lighting codes. The microprocessor **26** could transmit a signal to LED transistors **22** that drive the LEDs **12**.

In one embodiment, a signal from one light fixture could be transmitted over a network to the receiver of another light fixture. Any type of networking mechanisms (e.g., wired, wireless, optical communication) could be utilized for allowing communication between one or more stand-alone sensors and one or more light fixtures, between two or more light fixtures, and/or between one or more light fixtures and a central controller.

FIG. **3** is a flowchart showing processing steps according to an embodiment of the present disclosure, indicated generally at **32**, for controlling lights in a pool or spa. In step **34**, the color-changing light fixture **10** produces lights having predetermined colors, while, in step **36**, the microprocessor **26** simultaneously monitors the detection device, such as the sensor **14**. In step **38**, a determination is made as to whether a bather is detected in a swimming pool or spa. This determination is accomplished with the use of the sensor **14** detecting a parameter associated with the presence of a bather. If a negative determination is made, control returns to step **36**. Otherwise, if a positive determination is made in step **38**, step **40** occurs, wherein the microprocessor **26** initiates a timer for a predetermined period of time. Then or concurrently with the initiation of the timer, the microprocessor **26** adjusts the color of the light emitted from the LEDs **12** based on the sensor **14** such that a fixed light program is executed in step **42**. In the example shown in FIG. **3**, the light fixture **10** transmits a constant light output having a white color. In step **44**, a determination is made as to whether a timeout has occurred (e.g., whether the predetermined period of time has expired). If a negative determination is made, processing reverts to step **42**. Otherwise, in step **46**, another determination is made as to whether a bather is detected in a swimming pool or spa. This is accomplished using the sensor **14**. If a negative determination is made, control returns to step **34**, wherein the light fixture **10** emits lights having predetermined colors while the microprocessor **26** monitors the sensor **14**. Otherwise, if a positive determination is made in step **46**, control returns to step **40**, wherein the microprocessor **26** initiates the timer for another predetermined period of time. The processing steps shown in FIG. **3** allow a light fixture **10** to automatically change to full lumen white light when bathers are in a pool or spa.

In one embodiment, the sensor **14** senses one or more parameters associated with the operation of the pool, spa, or light. These parameters could include, for example, lumen performance, lumen output, amount of lumen depreciation, lighting component temperature, water temperature, flow rates, chlorination levels, pH levels, etc. If the microprocessor **26** determines that the parameter falls outside of a predetermined range based on a signal from the sensor **14**, the light fixture **10** could automatically transmit a constant light, such as a white color. The constant light could serve as an alarm to indicate that there is an issue with the pool, spa, or light.

FIG. **4** schematically illustrates a lighting system **48** constructed in accordance with the present disclosure for use in connection with a swimming pool **50**. More particularly, the lighting system **48** includes light fixtures **10***a*, **10***b* mounted to side walls **52**, **54**, respectively, of the pool **50**. The lighting system **48** could be equipped with a control system (not shown) which is connected to each of the light fixtures **10***a*, **10***b* for controlling the operation of the light fixtures **10***a*, **10***b*. One or more sensors **14** could be located in any desired location, such as in each of the light fixtures **10***a*, **10***b*. Alternatively or additionally, one or more sensors **14** could be located remotely from the light fixtures **10***a*, **10***b*, such as adjacent to the entrances of the pool **50**. In the example shown in FIG. **4**, sensors **14** are provided near a pool ladder **56**, steps **58** that lead into the pool **50**, and in each of the light fixtures **10***a*, **10***b*. A sensor **14** could be located outside of the pool **50**. One or more sensors **14** could be in communication with one or more light fixtures **10***a*, **10***b* through a wired network or a wireless network. For example, a signal from the sensor **14** located adjacent to the pool ladder **56** could be received by a receiver **24** in the light fixture **10***b*. It will be understood that the number of light fixtures and the number of sensors could vary.

FIG. **5** schematically illustrates a lighting system **148** constructed in accordance with an embodiment of the present disclosure for use in connection with a swimming pool **150**. More particularly, the lighting system **148** includes light fixtures **110***a*, **110***b*, **110***c* mounted to walls **152**, **154**, **156**, respectively, of the pool **50**. The lighting system **148** could be equipped with a control system **120** which is connected to each of the light fixtures **110***a*, **110***b*, **110***c* via power lines **122***a*, **122***b*, **122***c*, respectively, for controlling the operation of the light fixtures **110***a*, **110***b*, **110***c*. A sensor **114** could be located in any desired location, such as in the light fixture **110***a*, as shown in FIG. **5**. In this embodiment, the control system **120** utilizes networking between the light fixtures **110***a*, **110***b*, **110***c* through the power lines **122***a*, **122***b*, **122***c*. For example, a signal from the sensor **114** in the light fixture **110***a* could be used to control the light fixtures **110***b*, **110***c* through networking.

In one embodiment, serial RS-485 communications or Power Line Carrier (PLC) technology could be utilized between the control system **120** and the light fixtures **110***a*, **110***b*, **110***c*. Alternatively, the sensor **114** could be in communication with one or more light fixtures **110***a*, **110***b*, **110***c* through a wired network or a wireless network. Any suitable device could be utilized which allows networking and communication of the light fixtures **110***a*, **110***b*, **110***c* with the control system **120**.

In one embodiment, the lighting system **48**, **148** could include any type of luminaires, such as a dry luminaire located outside of the pool or spa, or a luminaire that is sporadically both wet and dry. Sensors **14**, **114** could be installed in each of these luminaires.

FIG. **6** schematically illustrates a bather condition detection system **248** of the present disclosure for use in connection with the swimming pool **50**. The bather condition detection system allows for detection of various conditions and/or activity associated with bathers, such as ingress into the pool, egress from the pool, splashing, game playing, drowning, distress, etc., using one or more pool or spa devices having acoustic, motion, pressure, sonar, or optical detection capabilities therein. The bather condition detection system **248** can be similar to the lighting systems **48**, **148** shown in and described in connection with FIGS. **1-5**, and can include like components which are described and referenced with like element numbers. The bather condition detection system **248** could include one or more light fixtures **10**, **10***a-b*, **110***a-c*, one or more return inlet fittings **250**, one or more suction outlets **252**, a floating wireless chemical sensor **254**, and a skimmer **256**. As shown in FIG. **6**, each of the light fixtures **10**, **10***a-b*, **110***a-c*, return inlet fittings **240**, suction outlets **252**, floating wireless chemical sensor **254**, and skimmer **256** can include a sensor **14** associated therewith. Further, the bather condition detection system **248** can include a plurality of sensors **14** that are not associated with any particular pool/spa device and are placed throughout the pool **50**, e.g., on the side walls **52**, **54**, on the pool ladder **56**, on a pool rail **258** associated with the steps **58**, etc., and outside of the pool **50**.

Each of the pool/spa devices, e.g., the light fixtures **10**, **10***a-b*, **110***a-c*, return inlet fittings **240**, suction outlets **252**, floating wireless chemical sensor **254**, and skimmer **256**, and individual sensors **14** can include the necessary hardware for operation. For example, as shown in FIG. **2**, the light fixtures **10** include a receiver **24**, a microprocessor **26**, a memory **28**, and a power supply **30**, among other components. Similarly, the other pool/spa devices, e.g., the return inlet fittings **240**, the suction outlets **252**, the floating wireless chemical sensor **254**, the skimmer **256**, and the independent sensors **14**, can also include a receiver **24**, a microprocessor **26**, a memory **28**, and a power supply **30**, as above-described.

In some embodiments, the pool/spa devices can be networked such that they are connected to a pool/spa control system **120** by wires **260**, or through a wireless connection **262**. For example, as shown in FIG. **6**, the floating wireless chemical sensor **254** communicates with the pool/spa control system **120** through a wireless connection **262**. However, it should be understood that the light fixtures **10**, **10***a-b*, **110***a-c*, return inlet fittings **240**, suction outlets **252**, skimmer **256**, and independent sensors **14** can also communicate with the pool/spa control system **120** through a wireless connection. Alternatively, in place of the pool/spa control system **120**, the pool/spa devices could communicate wirelessly with the cloud or a home Wi-Fi network.

In one embodiment of the bather condition detection system **248**, the sensors **14** are acoustic sensors, e.g., hydrophones or underwater microphones, that are capable of detecting and receiving underwater sounds/acoustical energy emanating from the pool **50**. The acoustic sensors **14** receive the underwater sounds/acoustical energy and sends an audio signal/waveform indicative of these sounds/acoustical energy to the microprocessor **26** for processing. Specifically, the microprocessor **26** is electrically connected to the memory **28**, which could have stored thereon an acoustic signature processing algorithm that is used to analyze the audio signal/waveform and determine if a bather condition/activity is present within the pool **50**. For example, the microprocessor **26** can analyze the audio signal/waveform using the acoustic signature processing algorithm stored on the memory **28** and determine if a swimmer is entering the

pool, exiting the pool, splashing, playing a game, drowning, or in distress. Upon determining that there is a bather condition/activity within the pool **50**, the microprocessor **26** can issue a command to perform an action. For example, the microprocessor **26** can instruct the light fixtures **10**, **10***a-b*, **110***a-c* to illuminate, change color, or perform a certain light show if it is determined that a bather has entered the pool or if a bather is splashing/playing a game. Alternatively, the action can be to turn off the light fixtures **10**, **10***a-b*, **110***a-c* if it is determined that the bather has exited the pool. As another option, the microprocessor **26** can indicate an alarm in order to alert a lifeguard or other individual in the vicinity of the pool **50** if it is determined that a bather is drowning or is in distress. The alarm can be a high volume continuous sound emitted from a speaker, a high volume intermittent sound emitted from a speaker, a change in light output from the light fixtures **10**, **10***a-b*, **110***a-c*, flashing the light output from the light fixtures **10**, **10***a-b*, **110***a-c*, etc. The alarm can continue until it times out or is manually reset.

In some embodiments, the bather condition/activity determination can be performed by the microprocessor **26** of each individual pool/spa device, e.g., the light fixtures **10**, **10***a-b*, **110***a-c*, the return inlet fittings **250**, the suction outlets **252**, the floating wireless chemical sensor **254**, the skimmer **256**, and the individual acoustic sensors **14**, whereby the microprocessor **26** analyzes the audio signal/waveform. However, in other embodiments, the bather condition/activity determination can be performed by the pool/spa control system **120** or by a remote server or cloud-based system. In such embodiments, the audio signal/waveform can be transferred to the pool/spa control system **120** or the remote server/cloud whereby it is analyzed according to the acoustic signature processing algorithm. The pool/spa control system **120** or the cloud can then send instructions to the necessary components for performing the requested action.

In some embodiments, where the pool/spa devices are networked, the bather condition/activity determination can be based on a plurality of audio signals/waveforms. That is, each of the pool/spa devices, e.g., the light fixtures **10**, **10***a-b*, **110***a-c*, the return inlet fittings **250**, the suction outlets **252**, the floating wireless chemical sensor **254**, the skimmer **256**, and the individual acoustic sensors **14**, can send a respective audio signal/waveform to the pool/spa control system **120** or the cloud, which can analyze all of the audio signals/waveforms together to determine if a bather condition/activity is present. Additionally, the pool/spa control system **120** or cloud could use positional information from each of the pool/spa devices in combination with the respective audio signals/waveforms in order to pinpoint the location in the pool **50** where the bather condition/activity is occurring.

FIG. **7** is a flowchart showing processing steps according to an embodiment of the present disclosure, indicated generally at **264**, for detecting a bather condition/activity and performing an action upon detection of a bather condition/activity. In step **266**, the microprocessor **26** of each pool/spa device monitors the acoustic sensor **14**. This involves receiving an underwater sound/acoustical energy and converting it into an audio signal/waveform. In step **268**, the microprocessor **26** analyzes the audio signal/waveform of the acoustic sensor **14** with the acoustic signature processing algorithm stored on the memory **28**. In step **270**, a determination is made as to whether a bather condition/activity is present in the pool **50**, e.g., a bather has entered the pool, a bather has exited the pool, or if a swimmer is in distress or is drowning. This determination is accomplished through the microprocessor **26** analyzing the audio signal/waveform received from the acoustic sensor **14** according to the acoustic signature processing algorithm. If a negative determination is made, control returns to step **266**. If a positive determination is made in step **270**, then step **272** occurs, wherein the microprocessor **26** issues an instruction to perform an action. For example, the microprocessor **26** can cause a speaker to emit a high volume continuous sound or a high volume intermittent sound, change the light color or intensity output of the light fixtures **10**, **10***a-b*, **110***a-c*, flash the light output from the light fixtures **10**, **10***a-b*, **110***a-c*, etc., depending on the bather condition/activity detected. The instruction issued by the microprocessor **26** can be keyed to the specific bather condition/activity detected and determined. In step **44**, a determination is made as to whether the action should be stopped. If a negative determination is made, processing reverts to step **272** and the action continues. Otherwise, if a positive determination is made, processing proceeds to step **276** where the microprocessor **26** issues a command to stop the action, and then reverts to step **266**. For example, if a user has manually stops the action or if a sufficient amount of time has passed since the start of the action then the system may stop the action and revert to step **266**.

It should be understood that while reference is made to the microprocessor **26** in connection with the steps of flowchart **264** shown in FIG. **7**, such steps can be performed by the pool/spa control system **120** or by the cloud.

It should also be understood that in some embodiments the sensor **14** can be a motion sensor, a pressure sensor, a wave detection sensor, a sonar detector, a passive sonar detector, an optical sensor, or any other sensor known in the art in place of or in addition to the acoustic sensor. In such embodiments, the audio signal would be replaced by a respective signal generated by the sensor/detector being implemented. The microprocessor **26** would analyze such signal and determine if there is a bather condition/activity based thereon.

While the disclosure has been described in terms of specific embodiments, it is evident in view of the foregoing description that numerous alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the disclosure is intended to encompass all such alternatives, modifications and variations which fall within the scope and spirit of the disclosure. What is desired to be protected by Letters Patent is set forth in the appended claims.

What is claimed is:

1. A bather detection system for a pool or spa, comprising:

a pool or spa device positionable at least partially within water of a pool or spa;

an acoustic sensor associated with the pool or spa device and configured to sense underwater sound and produce a signal indicative of the underwater sound; and

a processor in communication with the acoustic sensor and configured to analyze the signal to determine at least one of bather ingress or egress in the pool or spa,

wherein the processor issues an instruction to perform an action upon the determination of at least one of bather ingress or egress in the pool or spa, and

wherein the pool or spa device comprises a floating wireless chemical sensor, the acoustic sensor connected to the floating wireless chemical sensor.

2. The bather condition/activity detection system of claim **1**, comprising a memory in communication with the processor.

3. The bather detection system of claim 1, wherein the processor causes a speaker to sound an alarm upon the determination of at least one of bather ingress or egress in the pool or spa.

4. The bather detection system of claim 1, further comprising a light source.

5. The bather detection system of claim 4, wherein the processor causes the light source to change color upon the determination of at least one of bather ingress or egress in the pool or spa.

6. The bather detection system of claim 4, wherein the processor causes the light source to flash upon the determination of at least one of bather ingress or egress in the pool or spa.

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